

The Canadian Entomologist.

LXXIV

FEBRUARY, 1942

No. 2

NEW DESCRIPTIONS OF LARVAE OF FOREST INSECTS; II, *ANOMOGENA* (LEPIDOPTERA, PHALAENIDAE)*

BY A. W. A. BROWN AND W. C. MCGUFFIN,
Ottawa, Ontario

Anomogyna elimata Gn.

Antepenultimate Instar. Head width 1.4 mm. Body about 13 mm. long and 2 mm. wide. Crochets on first abdominal proleg number 14 to 16.

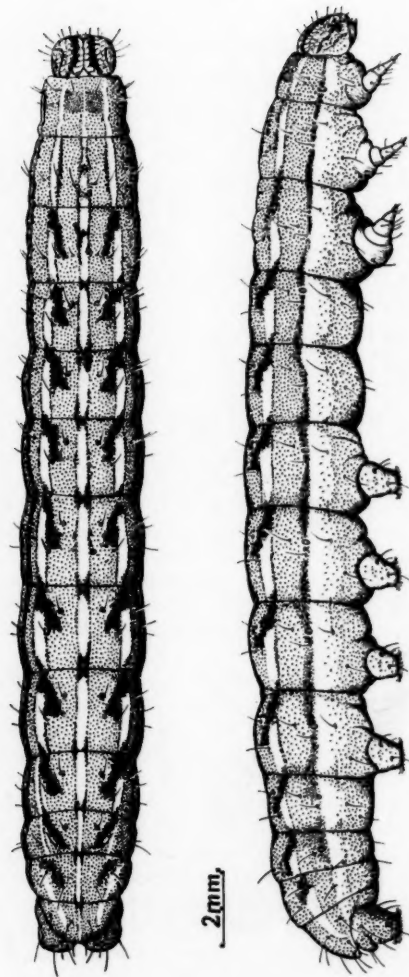
Penultimate Instar. Head width 1.7 to 2.0 mm. Body from 15 to 17 mm. long and about 2.5 mm. wide; ground colour medium to dark green, the moderately broad white dorsal line separated from the slightly broader white subdorsal lines by twice its width in ground colour; white patches, more conspicuous in anterior segments, immediately distad of each seta alpha; spiracular line dark green, subspiracular line white with a fringe of yellow. Head smooth and shiny, its ground colour medium to light green with a faint tinge of brown, the frons and antennal area bluish-green. Spiracles light brown with black rims. Thoracic legs medium green, sclerotized distally. Abdominal legs medium green. In some specimens of this instar, especially as the final moult is approached, beginnings of the black and brown pigmentation of the next instar may be noted.

Ultimate Instar. Head width 2.4 to 2.7 mm. Body 20 to 28 mm. long, 3 to 4.2 mm. wide; shape cylindrical, tapering at thorax and anal region; skin smooth; ground colour green to grey, closely mottled with brown and black, the middorsal and subdorsal lines white and narrow, edged with black; large black oblique patch in addorsal region of each segment, converging on the middorsal line of the next segment behind it; spiracular line black, irregular but well marked, the broad subspiracular line often comparatively white but darkening with age; venter light emerald green with white mottling, also darkening with age. Head with ground colour light greenish-brown with dark brown reticulate markings, a pair of dark ventral bands extending from the vertex along the distal edge of the adfrontals, and a dark patch around the ocellar area; preclypeus translucent white, furrowed, 2 to 4 times the median longitudinal width of the sculptured postclypeus, its distal margin slightly concave; labral cleft deep, at an angle of 90 degrees or more; distance between ocelli 1 and 2 is 1 to 1½ times that between ocelli 2 and 3. Prothoracic shield small and trapezoidal, bearing the subdorsal lines; anal shield poorly marked. Setigerous tubercles consisting of small dark-rimmed papillae, set directly on the integument (pinnacula wanting). Spiracles broadly elliptical, the white centres with glossy black rims. Thoracic legs greyish-green, brown distally. Abdominal legs green, bearing part of the subspiracular whitish line, the crochets of the 1st proleg numbering 20 to 26. Ventral prothoracic gland present. Specimens freshly moulted into this instar still largely retain the green colour pattern characteristic of the previous instar. However, the black and brown pigmentation gradually develops, finally to replace almost completely any residue of the green pattern.

Mandibles with 6 low rounded teeth, the first fused to the second, the

*Contribution No. 2118 from the Division of Entomology, Science Service, Department of Agriculture, Ottawa. This is the second of a series of contributions from the Canadian Forest Insect Survey.

PLATE IV.



LARVA OF ANOMOGYNA ELIMATA GN. (ULTIMATE INSTAR)

LXXIV

third
phary
scatte
narro
palpi

be fo

and

long
and
whit
equa
lines

4) an

area
regio
of th
ing
defi
whit
with
vert
area
epic
por
scul
bro
ocel
shie
shie
of c
ing
with
Ab
num

5 m
ind

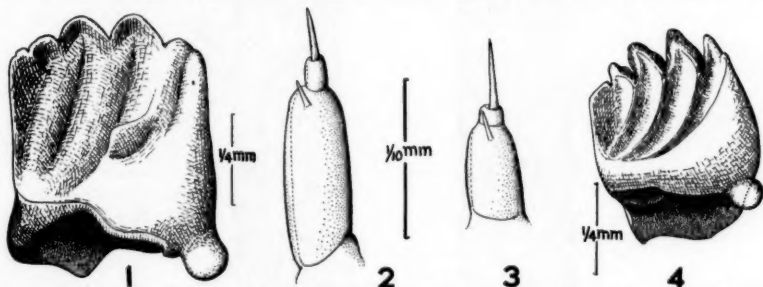
third and fourth the largest, and a rounded internal tooth (Fig. 1). Hypopharynx with lingua occupying one-third of its length, sparsely clothed with scattered minute spines, the gorge bare except anteriorly, the lobes narrow and densely spined. Spinneret 2 to 3 times as long as broad. Labial palpi with the segments in the proportion of 26:5:8, ranging to 15:5:7 (Fig. 3).

This species feeds on white, black, and Engelmann spruce and is also to be found on balsam fir, hemlock, red pine and jack pine.

***Anomogyna perquiritata* Morr.**

Antepenultimate Instar. Head width 1.4 mm. Body up to 20 mm. long and 3.0 mm. wide. Epicranial index 1.2. Otherwise similar to penultimate instar.

Penultimate Instar. Head width 2.0 to 2.5 mm. Body about 25 mm. long and 3.5 mm. wide; shape cylindrical, with only a slight taper at the cervical and anal shields; skin smooth, with minute granulations; ground colour greyish-white, irregularly mottled with dark grey to black, the totally black areas roughly equalling the totally white, making a pattern lacking definite longitudinal lines but consisting of a chain of segmental obliques; in each segment the white

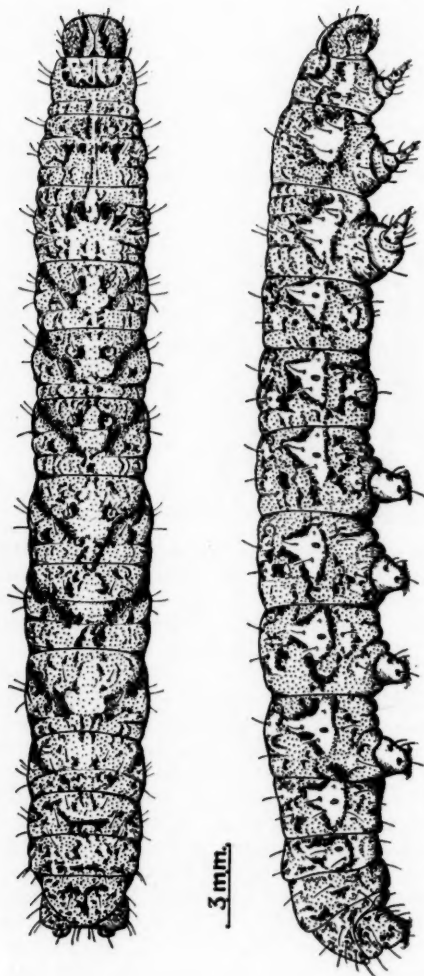


Mandible (Fig. 1) and Labial Palp (Fig. 2) of *Anomogyna elimata* Gn. Mandible (Fig. 4) and Labial Palp (Fig. 3) of *Anomogyna perquiritata* Morr.

areas are largest in the subdorsal and supraspiracular positions, the middorsal region with a trifoliate area outlined in black in each segment, the remainder of the black pigmentation on dorsum giving the general effect of obliques starting in one segment and converging in the next segment behind it; irregularly defined yellow areas lie anterior to the position of each spiracle; the venter is white, mottled with dark grey. Head smooth, the ground colour light brown with dark brown reticulation, a pair of dark vertical bands extending from the vertex along the distal edge of the adfrontals; in addition, the dark ocellar area may often send up irregular dark lines towards the back of the head; epicranial index 1.0, adfrontals with irregular wavy sutures and narrow basal portion; the preclypeus is 3 to 7 times the median longitudinal width of the sculptured postclypeus, translucent white, its ventral edge concave; labrum broad, with a deep well-rounded cleft at an angle of 110 degrees; distance from ocelli 1 to 2 is about three-quarters of that between 2 and 3. Cervical and anal shields present but not well defined, middorsal line distinguishable on cervical shield, the mottling of a slightly different shade. Setigerous tubercles consisting of dark-rimmed light papillae, set directly on the integument (pinnacula wanting); the setae small and inconspicuous. Spiracles elliptical, the brown centre with a heavy black rim. Thoracic legs very light brown, darker at joints. Abdominal legs dirty grey tinged distally with pink, the crochets on the 1st pair numbering from 26 to 32. Ventral prothoracic gland present.

Ultimate Instar. Head width 3.3 mm. Body about 30 mm. long and 5 mm. wide. Mottling of ground colour darker than in previous stage. Epicranial index 0.8, otherwise similar to penultimate instar.

PLATE V.

LARVA OF *ANOMOGYNA PERQUIRITATA* MORR. (ULTIMATE INSTAR)

Mandibles with 6 well-defined pointed teeth, the first fused to the second, with 3 conspicuous ridges but lacking an internal tooth (Fig. 4). Hypopharynx with lingua occupying one-third of its length, sparsely clothed with minute spines, the gorge bare, the lobes narrow and apparently bare. Spinneret twice as long as broad. Labial palpi with the segments in the proportion of 13:3:12 (Fig. 3).

This species feeds on white and black spruce in the boreal forest, and also on balsam fir.

A NOTE ON *COLIAS EURYTHEME* BDV., WITH DESCRIPTION OF A NEW RACE (LEPIDOPTERA, PIERIDAE)

BY KENNETH BOWMAN,

Edmonton, Alberta

During the summer of 1941, *Colias eurytheme* Bdv. appeared in the Edmonton district for the second time in twenty-five years, the last appearance having been in 1923. There was a large migration from the south in June, and from eggs laid by these migrants, the new generation appeared at the beginning of August and swarmed everywhere throughout the district. Both forms, *ariadne* and *amphidusa*, occurred and I had a good opportunity for comparing a race of *eurytheme* from the Peace River country and the northern boundary of Alberta with these two forms. The race is very distinct from either, and I consider it worthy of a name.

Colias eurytheme alberta n. subsp.

Male. Upper side bright red-orange, with the usual dark borders and with solid red-fringes. On the underside the usual black spots are reduced to a minimum, being absent on the secondaries.

Female. Upper side bright red-orange, with brown rather than black borders, those on the secondaries greatly reduced. The dark spots on the underside reduced to mere vestiges. Fringes solid red.

Holotype—♂, Wembley, Alta., June 24, 1925, in the author's collection.

Allotype—♀, Wembley Alta., June 25, 1925, in the author's collection.

Paratypes—7 ♂, 2 ♀, Wembley, Alta., June 14-25, 1925; 1 ♂, 1 ♀, Beaver Lodge, Alta., June 29 and July 12, 1924; 1 ♂, Fort Vermilion, Alta., June 13, 1925; 1 ♀, Boswell, B. C., July 22, 1927; 2 ♀, Rolla, B. C., July 1 and 21, 1927. Paratypes in the Canadian National Collection and in the collection of the author.

The white female (ab. ♀ *pallidissima* nov.) with the dark border of the upper side appearing merely as a narrow edging; the black spots of the underside scarcely evident; the fringes solid red.

Holotype—♀, Fort Vermilion, Alta., July 15, 1925, in the author's collection.

Paratypes—2 ♀, same locality, June 9 and 15, 1925, in the Canadian National Collection and the collection of the author.

The main distinctions of the new race are the color, which is more red than orange, and the solid red fringes.

BOTTOM TYPE AS A FACTOR INFLUENCING THE LOCAL DISTRIBUTION OF MAYFLY NYMPHS

BY J. P. LINDUSKA,

University of Montana, Missoula, Mont.

During the fall and winter of 1938 the author conducted a brief study of the food habits of trout in Rattlesnake Creek, Missoula County, Montana. In the course of this investigation numerous bottom samples were taken, the final analysis of which yielded interesting but incomplete information concerning the distribution of several species of mayfly nymphs over part of the stream. It was apparent from these samples that the mayfly species composition of the fauna varied markedly over the comparatively short section of the stream studied, and marked changes were noted in the dominance of certain species within one particular area. The present study was carried out to determine more specifically the differences in species composition over this section of the stream, and to observe the conditions that might be associated with the known differences in relative numbers of the nymphs of several species.

THE AREA STUDIED AND METHODS

Rattlesnake Creek is a small spring-fed creek which retains a fairly uniform flow throughout the year. For a short period during the spring melting snows raise the water level considerably and the flow may be torrential for a short time. The water is clear except for this brief flood period, and low temperatures with high oxygenation obtain the year around. The fact that the stream is well shaded throughout most of its course helps in maintaining uniformly low temperatures. Preliminary chemical studies showed that oxygen and carbon dioxide content, and hydrogen-ion concentrations for any one period were practically the same over the limits of the stream studied. Although a small dam divides the study area, it appeared not to be a modifying factor. The portions of stream lying immediately below the dam showed an average temperature of from one to three degrees (C) higher, but aside from this no differences attributable to the dam were noted for the two areas.

The portion of the stream selected for study is clearly separable into two sections. One section (Region 1) extends from the point where the stream enters the Clark fork of the Columbia River to the small dam lying about two and one-half miles upstream. The creek bed in most of this region is broad with numerous shallow riffles. The bottom is composed of gravel and small stones with large rocks and boulders occurring only sparingly. Precipitated organic material is present over much of the stream bed in this area. Study in this portion of the stream was confined to a short area one-half mile in length below the dam. A short distance above the small dam (Region 2) the creek narrows down and a profound change is seen in the nature of its bed. Boulders and large rock fragments form the greater part of the bottom and only slight amounts of precipitated organic materials are present. Flat rock ledges in part of the creek bed and sheer rock walls contrast with the low soil banks of the lower part of the stream. Collections in this area were confined to a half-mile stretch immediately above the dam.

Because of the nature of some collecting sites exact quantitative measures were not attempted. The size of the sample taken was, however, kept as nearly uniform as possible. Samples were taken by churning a bottom area about 16 inches square and catching the dislodged insects in a net which was placed immediately below. All the nymphs taken in the collection were later identified and counted so that the relative numbers of each species could be determined. The type of bottom, stream depth, and position of insects in the habitat were recorded for each collection. The approximate velocity was taken by means

of a small acoustic current meter. An equal number of collections were made in each region and in situations showing similar surface velocities.

RESULTS

Table 1 shows the 12 commonest species found, arranged in order of abundance as they occurred in the two regions studied. The relative numbers of each species as indicated is based on the per cent by total of all nymphs collected.

TABLE 1

The 12 Commonest Species Arranged in Order of Relative Abundance as They Occurred in Collections from Regions 1 and 2.

Region 1		Region 2	
Species	Abundance	Species	Abundance
<i>Cinygmula</i> sp.	A	<i>Ironopsis</i> sp.	A
<i>Ephemerella inermis</i> Eaton	C	<i>Ephemerella doddsi</i> Needh.	C
<i>Ephemerella yosemita</i> Trav.	C	<i>Rhithrogena doddsi</i> McD.	C
<i>Ephemerella doddsi</i> Needh.	P	<i>Ephemerella inermis</i> Eaton	C
<i>Rhithrogena doddsi</i> McD.	P	<i>Rhithrogena virilis</i> McD.	C
<i>Leptophlebia adoptiva</i> McD.	P	<i>Iron longimanus</i> Eaton	P
<i>Baetis intermedius</i> Dodds	P	<i>Cinygmula</i> sp.	P
<i>Rhithrogena virilis</i> McD.	P	<i>Ephemerella</i> sp.	P
<i>Iron longimanus</i> Eaton	P	<i>Baetis intermedius</i> Dodds	P
<i>Ephemerella</i> sp.	P	<i>Leptophlebia adoptiva</i> McD.	P
<i>Baetis vagans</i> McD.	P	<i>Baetis vagans</i> McD.	P
<i>Ironopsis</i> sp.	P	<i>Ephemerella yosemita</i> Trav.	*

A—Abundant. Averaging over 25% of all mayfly nymphs taken.

C—Common. Averaging 10 to 24% of all mayfly nymphs taken.

P—Present. Averaging less than 10% of all mayfly nymphs taken.

*—Not taken in this portion of the stream.

Several significant differences in the population composition of the two areas can be seen from Table 1. *Cinygmula* sp., which proved to be nearly twice as common as all the other species combined in region 1, is only seventh in order of abundance in region 2, and some collections made above this point indicated that the species becomes less common upstream. Similarly, *Ironopsis* sp., the commonest nymph found in region 2, was last in order of abundance in region 1. Another significant difference is seen in the relative numbers of *Ephemerella yosemita* Trav. taken. This nymph, which was consistently taken in the lower region, did not occur in collections from the upstream section. Other species were observed to be more common in one or another section of the stream but the differences were not so marked.

Analysis of collections further showed that the three species exhibiting the most pronounced differences in local numbers were also the most consistent in the "selection" of a given type of substratum. For instance, *Ephemerella yosemita* showed a decided "preference" for a rubble bottom, and reached the greatest concentrations in this situation when there was an overlay of organic material present. These requirements of bottom type were most commonly met with in region 1. *Cinygmula* sp. was taken most often over a bottom of intermediate sized rock and "avoided" the extremes of gravel and boulder bottoms. This nymph was the decided dominant in region 1 where the stream bed was principally of this nature. The nymph, *Ironopsis* sp., was observed to be the dominant form in the upper portion of the stream where flat-rock ledges made up much of the stream bed. With the exception of *Ephemerella doddsi* Needh., other members of this genus taken showed definite "preferences" for areas containing some organic debris although they were not completely restricted to this condition. The 12 commonest species taken, with notes on the conditions under which they occurred in greatest numbers, are given in Table 2.

TABLE 2
Observations of the Commoner Species Collected and Where They Were Found in Greatest Numbers.

Species	Preferred habitat (bottom type)	Position in habitat	Range of surface velocities (ft. per. sec.) over habitat in which found.
<i>Cinygmula</i> sp.	Rock-rubble, "Avoided" gravel and boulder bottoms.	Under stones.	0-8
<i>Ironopsis</i> sp.	Rock-boulder and rock ledges.	Mostly on underside of rocks. Moved freely over boulder surface.	0-8
<i>Ephemerella yosemite</i> Trav.	Rubble bottom in shallow riffle with organic debris.	On and under organic material.	0-5
<i>Ephemerella doddasi</i> Needh.	Deep rapids, smooth rocks and boulders, clean bottom.	Common on under side of rocks. Observed on sides and top of boulders.	0-8
<i>Ephemerella inermis</i> Eaton	Gravel-large rock when trash present.	In gravel and trash. Occasionally between rocks.	0-8
<i>Ephemerella</i> sp.	Gravel-large rock when trash present.	In gravel and trash. Occasionally between rocks.	0-8
<i>Rhithrogena virilis</i> McD.	Rubble beds around base of boulders.	Moved about quite freely. On and under stones.	0-8.5
<i>Rhithrogena doddasi</i> McD.	Rock-boulder.	On and under rocks. On sides of boulder near base.	0-8
<i>Leptophlebia adolptiva</i> McD.	Large rock.	Behind and under stones.	0-8
<i>Iron longimanus</i> Eaton	Stream's edge.	On and under stones. Moves over stone surface.	0-8
<i>Baetis intermedius</i> Dodds	Stream's edge. Silt covered rocks. In swifter regions.	On and under stones. Occasionally on boulders.	0-8
<i>Baetis vagans</i> McD.	Large rocks.	Free ranging. Occasionally on boulders.	0-8

DISCUSSION

Students of lotic communities have generally considered the rate of flow of water to be of paramount importance in governing the distribution of aquatic organisms. Hora (1929) has stated: "Of the physical conditions that influence the ecological distribution of the torrential fauna, the principal one is the rate of flow of the current." The "morphological adaptations" of various mayfly nymphs to conditions of stream flow have been pointed out by Dodds and Hisaw (1924). It has since been demonstrated by Ide (1935) that over the course of a stream the distribution of mayflies is governed largely by temperature of the water. In this connection he further suggests that: "Within the limits set by temperatures are other limits set by the strength of current and the nature of the bottom." It can generally be concluded from his work that the general distribution of mayflies is limited primarily by temperature differences but local distribution may be affected by other physical or biological factors. The response of one species (*Chironetes albomanicatus* Needh.) to some of these factors has been studied in some detail by Clemens (1917). Clemens showed the importance of the bottom in controlling the rate of flow of the water and found that although the nymphs of *C. albomanicatus* were capable of sustaining themselves in a flow of 4.3 feet per second, they lived in a much diminished current. They were able to accomplish this by living beneath stones and rubble, a bottom type for which they showed a decided "preference" even when stream velocity was low enough to be of little consequence.

The present study clearly indicates the response of several species to certain conditions of bottom type and shows the importance of this factor in governing the local distribution of mayfly nymphs. Certain species were observed to "select" certain bottom types without respect to stream velocity, and this "preference" was further observed to be strong enough in several cases to limit some species to those portions of the stream in which certain requirements of bottom type could be met. The differences, between two sections of the stream, in the relative numbers of certain nymphs, showed a correlation with the type of bottom most characteristic of either section, and given species reached their greatest numbers in parts of the stream where the "preferred" substratum was general. In evaluating these apparent effects of bottom type it is appreciated that the type of bottom and flow of water are in a measure inseparable. In the final analysis the composition of the stream bottom is determined by the flow of the water which consequently must be considered the primary factor. Within small units of a stream, however, the direct effects of current and bottom type can be observed independently, and the present discussion refers to stream flow as such a force in the immediate environment of aquatic organisms.

Since the nature of the bottom can so profoundly affect the rate of flow of water it appears that stream flow, as such, would necessarily be of secondary importance to bottom-dwelling forms. An irregular bottom affords many places of greatly reduced velocity so that even where the surface speed may be torrential, species not "morphologically adapted" may inhabit these situations by avoiding the main force of the current. In this connection it might be pointed out that specimens of *Leptophlebia adoptiva* McD., an extremely fragile crawling form, were consistently taken in sites where the surface velocity was up to 8 feet per second, a feat which it was able to accomplish by keeping to the bottom and living beneath and behind the larger rocks. That this "preference" for larger rocks was not strictly a means of avoiding the current is, however, shown from the fact that this species was also common in this type of bottom in parts of the stream where the surface velocity was greatly diminished. No instance was observed where the distribution of any species within the stream bed appeared limited by the action of stream flow, as such. It was noted, however, that the

position of many species in a given site was apparently determined by the stream velocity. Observations made on large boulders in torrential parts of the stream showed that the localization of various species on boulders was quite constant in many cases. For instance, in a surface velocity of 8 feet per second the top surface of a 20-inch boulder was most often observed inhabited by nymphs of *Ironopsis* sp., *Baetis intermedius* Dodds, and *Baetis bicaudatus* Dodds, the stream velocity at this point being from five to eight feet per second. These species often had a general distribution over the rock surface but were usually the only ones found on the tops of the boulders where the speed is greatest. Midway on the sides of the boulder where the stream speed measured from two to four feet per second, were found the species *Iron longimanus* Eaton and *Ephemerella doddsi* Needh. These two species could occasionally be seen near the surface of the boulder but on the downstream side where the current is reduced. *Baetis vagans* McD., a free ranging species, was observed in positions where the flow was up to four feet per second, and the nymph of *Rhithrogena doddsi* McD. when present on boulders, was usually confined to the lower sides where the current did not exceed two feet per second. Nymphs of the remaining species were most commonly taken on the smaller stones of the bottom and between and under the stones around the boulder. Nymphs of *Cinygmula* sp., and *Rhithrogena virilis* McD., were observed only on the bottom between and under stones, and *Ephemerella inermis* Eaton and *E. yosemite* Trav. were found to occupy the debris which usually gathers around the base of boulders. This zonation of species demonstrates the part stream speed may play in bringing about what might be termed vertical distribution due to the varying ability of different species to withstand current.

SUMMARY

In a study conducted to determine the factors responsible for limiting the local distribution of mayfly nymphs, it was found that:

1. Each of several species studied occurred in greatest concentrations in well defined types of stream bottom.
2. The requirements by several species of nymphs for a given type of substratum were so well defined as to exclude them from portions of the stream lacking in given bottom types. Limitations on the local distribution of these species was the observed result.
3. Stream flow, as such, appeared to be of no appreciable consequence in limiting local distribution, and most species were observed capable of inhabiting situations under a wide range of surface velocities wherever acceptable bottom types occurred.
4. Within a given site, stream flow appeared responsible for a vertical distribution of nymphs, due presumably to the different abilities of species to withstand current.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. G. B. Castle for suggestions concerning the carrying out of the work and preparation of the manuscript, and Dr. F. P. Ide for checking identification of several of the nymphs.

LITERATURE CITED

- Clemens, W. A. 1917. An Ecological Study of the Mayfly, *Chironetes*, Univ. Toronto, Studies, biol. ser. 17.
- Dodds, G. S. and F. L. Hisaw, 1924. Ecological Studies of Aquatic Insects. I. Adaptation of Mayfly Nymphs to Swift Streams. Ecology 5:137-149.
- Hora, Sundar Lal. 1930. Ecology, Bionomics and Evolution of the Torrential Fauna, with Special Reference to the Organs of Attachment. Phil. Trans. Roy. Soc. London. Sec. B, 218, 171-282.
- Ide, F. P. 1935. The Effect of Temperature on the Distribution of the Mayfly Fauna of a Stream. University of Toronto Studies, biol. ser. 39.

A REVISED CHECK LIST OF THE BUTTERFLIES OF MANITOBA

BY G. SHIRLEY BROOKS,
The Manitoba Museum, Winnipeg, Manitoba.

This list is based on one compiled by Dr. H. J. Brodie of Winnipeg and published in the *Transactions of the Royal Canadian Institute*, vol. XVII, part 1, 1929. Since that time the completion of the Hudson Bay Railway to Churchill has opened up territory, which previously had been but slightly worked and has made easily accessible country where the flora and fauna are subarctic. Also a number of new species, subspecies, races, and aberrations have been described from the Province, which seems to make a revised check list advisable. The old list contained 121 names, and that total has now been brought to about 170.

Every care has been taken to attain accuracy, but the writer will be only too pleased to be advised of any inaccuracies or omissions. *Papilio nitra* Edw., and its form *khali* Cherm., are both shown as being taken on Riding Mountain, although it seems doubtful if two forms occur in the locality. For many years the Manitoban form of *Euchloe* was considered to be *ausonides* Bdv. Later it was called *coloradensis* H. Edw.; now Mr. dos Passos states, as his opinion, that specimens from Manitoba should be called *mayi* which was described in the *Canadian Entomologist* for April, 1940, by F. H. and R. L. Chermock. *Mayi* was described from Riding Mountain which is on the western side of the Province. According to Dr. McDunnough's determination, *Colias philodice* Godt. may not occur here. This question is still unsettled, and the species is retained in the list. *Colias christina mayi* Cherm. (Can. Ent., Apr., 1940) takes the place of the species *christina* Edw.; Dr. McDunnough considers this a poor race of *gigantea* Stkr., and believes it should be so placed. *C. gigantea* is probably the most common *Colias* met with between The Pas and Churchill.

Coenonympha inornata Edw. occurs in the upper Lake Winnipeg region, and its prairie race, *benjamini*, was recorded from the Province by Dr. McDunnough (1928, Can. Ent., LX, 273). *Oeneis jutta* Hbn. occurs in various parts of the Province from Aweme to Churchill, wherever there are larch swamps. This species has been called *jutta* Hbn., but dos Passos considers that the recently proposed *O. jutta ridingiana* should be substituted. *Argynnis cybele* Fabr. has, in the past, been considered the species occurring here. Chermock has described a new race, *pseudocarpenteri*. This, according to his description, occurs only in a limited area, so for the present *cybele* Fabr. remains. A new race, *hollandi* Cherm., has been added to *Argynnis atlantis* Edw. The same reason for allowing *cybele* to remain applies to *atlantis*. As the writer has not had access to Chermock's types, it has been impossible to make comparisons.

A number of the species recorded in this list are "strays" and almost certainly do not breed in the Province. The late Norman Criddle of Aweme collected a number of these during a period of about forty years. Among the visitors are *Zerene caesonia* Stoll. of which there are two records; of *Nathalis iole* Bdv. two have been taken; of *Erema mexicana* Dru., three; *Argynnis idalia* Dru., one; *eurynome* Edw., two; *Junonia coenia* Hbn., four. Doubtless the strong and continuous south winds which frequently occur in Manitoba in late spring and early summer account for the presence of the majority of the southern visitors taken here; these are usually worn specimens and look as though they had travelled a long way. On the other hand, some are in perfect condition and lead one to think that they have only just emerged from the pupae. The writer is of the opinion that they may have been brought here by rail.

Strymon heathi Flecth. is considered an aberration of *calanus* Hbn. *Oeneis macouni* Edw. has been taken only in a limited area at Victoria Beach where it flies at irregular periods among *Pinus banksiana*. One year it may be abundant, and then it may not be seen for several years. *Oeneis chryxus calais*

Scud. has been found only in another limited area near Gillam, but there is no reason why these, and other species of limited range, should not be taken in districts of similar nature. Manitoba covers a very large area between latitude 49° and 60°, and only a very small part has been systematically worked..

The records from Beulah, Birtle, and Miniota have been submitted by Mr. Jack Dennis of Birtle who has collected in western Manitoba for forty-five years.

The localities where each species has actually been taken are given but these do not, of course, cover the specie's entire range. At The Pas, situated near the western boundary of Manitoba just south of latitude 54°, more southern and more northern forms are found together, but as one travels along the Hudson Bay railway, southern species gradually become scarcer, and species of a more northern distribution are found. This becomes more noticeable when Gillam, mile 327, is reached.

The writer wishes to express his sincere thanks to Dr. J. McDunnough, Ottawa; Mr. Cyril dos Passos, Mendham, N. J.; and Mr. J. B. Wallis, Winnipeg, for their great kindness in assisting with information, advice, and constructive criticism. Without their help this list would have been very incomplete. Tribute must also be paid to Dr. H. J. Brodie whose preliminary list covered the earlier records.

ABBREVIATIONS USED FOR LOCALITIES.

Aw.—Aweme.	NH.—Norway House.
BH.—Bird's Hill.	RM.—Riding Mountain.
Beu.—Beulah.	Rs.—Rosebank.
Bir.—Birtle.	Sl.—Sandilands.
Ct.—Cartwright.	SM.—Stony Mountain.
Ch.—Churchill.	SS.—Seven Sisters Falls.
FtA.—Fort Alexander.	Tr.—Trauscona.
Gil.—Gillam.	TheP.—The Pas.
Hs.—Husavick.	VB.—Victoria Beach.
M200—Mile 200, H. B. Rly.	Wab.—Wabowden.
MM.—McMunn.	Wb.—Westbourne.
Mi.—Miami.	Wg.—Winnipeg.
Min.—Miniota.	Gen. Dist.—Generally distributed in southern Manitoba.

The numbers refer to Dr. J. McDunnough's Check List of the Lepidoptera of Canada and the United States of America, 1938.

LIST OF SPECIES

PAPILIONIDAE.

4. *Papilio ajax* L. Gen. Dist.
6. *bairdii* Edw. Beu., Bir.
- 6a. *bairdii oregonia* Edw. Beu.
7. *nitra* Edw. RM.
7. *nitra f. kahli* Cherm. R.M.
8. *zelicaon* Luc. Beu., Miniota.
- 9b. *machaon hudsonianus* Clark. RM., Gil.
- 15a. *glaucus canadensis* R & J. Gen. Dist., Ch.

PIERIDAE.

- 36b. *Euchloe ausonides coloradensis* H. Edw. VB., Gil., Ch., Lake George.
- 36c. *ausonides mayi* Cherm. RM.
- 39a. *Colias hecla glacialis* McLach. Ch.
- 39b. *hecla hela* Stkr. Ch.
41. *eurytheme* Bdv. Gen. Dist., Ch.

41. *eurytheme* f. *amphidusa* Bdv. RM., Beu., Bir.
 41. *eurytheme* f. *eriphle* Edw. Gen. Dist. *See corrections p. 242*
 41. *eurytheme* f. *eriphyle* Edw. Gen. Dist.
 42. *philodice* Godt. Gen. Dist.
 45. *interior* Scud. VB., Vivian, SS., TheJ., M200.
 46. *christina* Edw. Beu., Bir.
 46b. *christina mayi* Cherm. RM.
 46b. *christina mayi* f. *marjorie* Cherm. RM.
 48. *gigantea* Stkr. TheP., M200., Gil., Ch.
 51a. *palaeno chippewa* Kby. M200, Gil., Ch.
 52c. *nastes moina* Stkr. Ch.
 52c. *nastes moina* ab. *harperi* Gund. Ch.
 55. *Zerene caesonina* Stoll. Aw., Ct.
 69. *Eurema mexicana* Bdv. Aw., Ct., Stonewall.
 75. *Nathalis iole* Bdv. Aw., Wg.,
 81. *Pieris occidentalis* Reak. Beu., Miniota.
 81a. *occidentalis calyce* Edw. Beu., Miniota.
 81b. *occidentalis nelsoni* Edw. Ch.
 82. *protodice* Bdv. & Lec. Gen. Dist.
 83d. *napi* gen. vern. *oleracea* Harr. Wg., VB., Ct., Hs., Ch., Beu.
 83d. *napi* gen. aest. *cruciferarum* Bdv. VB., RM., BH., TheP., Beu.
 86. *rapae* L. Gen. Dist.

DANAIDAE.

89. *Danaus pelxippus* L. Gen. Dist.

SATYRIDAE.

- 96b. *Enodia portlandia borealis* Clk. Wg., VB., Ct., Aw., BH., Sl., Beu., Bir.
 103. *Megisto eurytus* Fabr. Wg., Ct., SM., VB., Tr., FtA., Beu.
 106a. *Satyrodes eurydice transmontana* Gosse. Wg., VB., Aw., BH., Beu., Bir.
 106a. *eurydice transmontana* f. *rawsoni* Field. RM.
 109. *Coenonympha inornata* Edw. Northern Manitoba.
 109b. *inornata benjamini* McD. Southern Manitoba.
 115. *Eumenis ridingsii* Edw. Aw.
 117d. *Minois alope olympus* Edw. Gen. Dist.
 125. *Oeneis macounii* Edw. VB.
 127c. *chryxus calais* Scud. Gil.
 128a. *daura alberta* E. & E. Aw., Beu., Bir.
 129. *taygete* Gey. Ch.
 130e. *jutta ridingiana* Cherm. RM., Aw., TheP., Gil., Ch., FtA.
 131a. *uhleri varuna* tr. f. *dennisi* Gund. Beulah. *See p. 242*
 131a. *uhleri varuna* tr. f. *dennisi* Gund. Beulah.
 136. *polixenes* Fabr. Ch.
 138d. *melissa semplei* Holl. Ch.
 143a. *Erebia rossi ornata* Leuss. Ch.
 144a. *disa mancinus* Dbldy. & Hew. Aw., Gil.
 148. *discoidalis* Kby. VB., Aw., Ct., RM., Ch., Beu., Bir.
 149d. *theano canadensis* f. *churchillensis* Warr. Ch. *See p. 242*
 149d. *theano canadensis* f. *churchillensis* Warr. Ch.
 150. *epipsodea* Btlr. Aw., TheP., Beu.

NYMPHALIDAE.

- 158a. *Dione vanillae comstocki* Gund. Aw.

159. *Euptoieta claudia* Cram. Gen. Dist.
 161. *Argynnis idalia* Dru. Wg.
 166. *cybele* Fabr. Gen. Dist.
 166d. *cybele pseudocarpenteri* Cherm. RM., Sand Ridge, Miniota.
 167b. *aphrodite cypris* Edw. Tr. *cf. major* Gund. Kilmord. See p. 292
 167c. *aphrodite columbia* Hy. Edw. VB., TheP.
 169. *lais* Edw. Wg., Ct., RM., Beu., Bir.
 169. *lais ab. dennis* Cuv. d. Beu.
 171. *atlantis* Edw. Gen. Dist.
 171d. *atlantis hollandi* Cherm. RM., Sand Ridge.
 180. *edwardsii* Reak. Beu., Min.
 191. *nevadensis* Edw. Beu., Min.
 191a. *nevadensis calgariana* McD. Aw., VB., Beu.
 199. *eurynome* Edw. Hamiota, Beu.
 200. *Brenthis myrina* Cram. Gen. Dist.
 202c. *aphirape dawsoni* B. & McD. VB., FtA., TheP., Gil., Ch.
 202c. *aphirape dawsoni ab. harperi* Gund. Ch.
 206a. *chariclea boisduvalii* Dup. Ch.
 206b. *chariclea grandis* B. & McD. RM., TheP., FtA.
 208. *freijs* Thun. RM., TheP., Gil., Ch.
 210. *polaris* Bdv. Ch.
 211a. *frigga saga* Staud. MM., RM., TheP., Gil., Ch.
 212. *Brenthis bellona* Fabr. Wg., VB., Ct., Tr., Gil., Beu., Bir.
 256. *Melitaea harrisii* Scud. VB., Beu., Bir.
 257. *hanhami* Fletch. VB., Aw., RM., Beu.
 262. *Phyciodes gorgone* Hbn. Wg., Ct., Tr., RM., Beu., Bir.
 263. *nycteis* Dbldy. & Hew. Wg., VB., Aw., Ct., Beu.
 263. *nycteis reversa* Cherm. RM., Sand Ridge.
 265. *tharos* Dru. Gen. Dist., M200.
 266. *batesii* Reak. Wg., VB., Aw.
 266. *batesii ab. harperi* Gund. McCreary.
 285. *Polygonia interrogationis* Fabr. Aw., Ct., Beu.
 285. *interrogationis f. fabricii* Edw. Aw., Ct., Beu.
 286. *comma* Harris. Aw., Ct., RM., Beu.
 286. *comma f. dryas* Edw. Aw., Ct., Mi., Beu.
 287. *satyrus* Edw. Wg., Ct., VB., TheP., Beu., Bir.
 288. *faunus* Edw. VB., Ct., Hs., TheP., Beu., Bit.
 291. *zephyrus* Edw. Aw., Beu.
 294. *progne* Cram. Gen. Dist.
 295. *Nymphalis jalbum* Bdv. & Lec. Tr., VB., Aw., Ct., FtA., Beu., Bir.
 296. *californica* Bdv. Min.
 297. *milberti* Godt. Gen. Dist., Ch.
 297. *milberti ab. rothkei* Gund. VB.
 298. *antiopa* L. Gen. Dist., Ch.
 299. *Vanessa atalanta* L. Gen. Dist., Ch.
 300. *virginiensis* Dru. VB., Ct., Tr., Beu., Bir.
 301. *cardui* L. Gen. Dist., Ch.
 303. *Junonia coenia* Hbn. Wg., Hs., Bir., Sl.
 321. *Basilarchia arthemis* Dru. VB., Wb., Aw., M200., FtA.
 321. *artemis f. prosperpina* Edw. Wg., Aw.
 321a. *artemis rubrofasciata* B. & McD., Gen. Dist.
 325. *archippus* Cram. Gen. Dist.
 325. *archippus hyb. rubrifasechippus* Gun. Beu.

LYCAENIDAE.

- 373 *Strymon melinus* Hbn. Wg., Aw.
 380. *titus* Fabr. Wg., Aw., Ct., Beu., Bir.
 381. *acadica* Edw. Wg., Aw., Ct., Beu., Bir.
 385. *edwardsii* Saund. Aw.
 386. *calanus* Hbn. Min.
 387. *falacer* Godt. Aw., Ct.
 388. *heathii* Fletch. Ct.
 389a. *liparops strigosa* Harr. BH., VB., Wg., Ct., Hs., Beu., Bir.
 403. *Incisalia augustus* Kby. VB., Ct., SM., Gil., Beu.
 409. *polios* Cook & Wats. VB., Sl., Tr., Beu.
 413. *niphon* Hbn. VB., Beu..
 419. *Feniseca tarquinius* Fabr. Sl.
 424. *Lycaena thoe* Guer. Gen. Dist.
 427. *dione* Scud. Wg., Hs., VB., Rs., Beu., Bir.
 427. *dione* ab. *gibboni* Gund. Min.
 432. *helloides* Bdv. Wg., Ct., VB., Tr., Beu., Bir.
 433. *dorcas* Kby. Wg., FtA., TheP., M200.
 448. *Everes amyntula* Bdv. Gen. Dist., Ch.
 449. *Plebeius scudderii* Edw. VB., TheP., NH.
 450. *melissa* Edw. Tr., Wg., VB., Ct., BH., Beu., Bir.
 452. *aquilo* Bdv. TheP., Ch.
 452a. *aquilo rustica* Edw. Wg., Aw., Ct., SM., Beu.
 452e. *aquilo lacustris* Freem. Cormorant Lake, NH., TheP.
 453. *saepiolus* Bdv. Gen. Dist.
 454a. *optilete yukona* Holl. Gil., TheP.
 473a. *Glaucopsyche lygdamus couperi* Grt. Gen. Dist.
 475. *Lycaenopsis pseudargiolus* Bdv. & Lec. Wg., Ct., VB., Sl., Beu., Bir.
 475. *Lycaenopsis pseudargiolus* gen. aest. *neglecta* Edw. Ct., SM., Beu.
 475a. *pseudargiolus lucia* f. *marginata* Edw. Wg., VB., BH., Beu.
 475b. *pseudargiolus argentata* Fletch.. Aw., Mi., Beu.

HESPERIDAE.

484. *Epargyreus tityrus* Fabr. Gen. Dist.
 505. *Thorybes pylades* Scud. Wg., VB., BH., Ct., Beu., Bir.
 151a. *Pyrgus centaureae freija* Warr. Ch., Gil.
 521. *communis* Grt. Wg., Aw., Tr., Beu., Bir.
 541. *Erynnis icelus* Scud. & Burg. Wg., Aw., Ct., VB., Tr., Beu.
 542. *brizo* Bdv. Wg., Aw., Ct., BH., Beu., Bir.
 546. *persius* Scud. RM., Beu., Bir.
 551. *juvenalis* Fabr. Wg., Ct., VB., Beu., Bir.
 563. *Carterocephalus palaemon* Pall. Gen. Dist.
 567. *Ancyloxypha numitor* Fabr. Wg., VB., Aw., Hs., Bir.
 569. *Oarisma garita* Reak. Wg., Aw., Ct., RM., Beu., Bir.
 579. *Hesperia uncas* Edw. Wb., Beu.
 584b. *comma manitoba* Scud. Ct., Tr., Beu., Bir.
 584d. *comma assiniboia* Lym. Wg., Tr., Bowman, Beu., Bir.
 591. *leonardus* Harr. VB.
 597. *ottoe* Edw. Aw.
 611. *Polites themistocles* Latr. Wg., Aw., Ct., Tr., FtA., Beu., Bir.
 614. *peckius* Kby. Tr., VB., Ct., Hs., TheP., Beu., Bir.
 618. *mystic* Scud. VB., Ct., Hs., Beu., Bir.
 624. *Poanes hobomok* Harr. Wg., Ct., VB., Mi., RM., Bowman, Beu., Bir.

624. *hobomok* f. ♀ *pocahontas* Scud. Wg.
 624. *hobomok* f. *ridingsii* Cherm. RM., Sand Ridge.
 635a. *Atrytone logan lagus* Edw. Aw.
 642. *uricola* Bdv. Gen. Dist.
 644. *Atrytonopsis hianna* Scud. Aw., Beu.
 660. *Amblyscirtes vialis* Edw. Wg., VB., Ct., RM., Beu., Bir.
 661. *hegon* Scud. Wg., SM., RM., Beu.

NOTES

RETIREMENT OF DR. ARTHUR GIBSON

On January 15, Dr. Arthur Gibson retired from active duties as Dominion Entomologist and Associate Director of Science Service and is at present on retiring leave which will expire on July 15, 1942. L. S. McLaine has been appointed Acting Dominion Entomologist.

VARIETAL SUSCEPTIBILITY OF POTATOES TO APHID INJURY

Since 1938, the Division of Entomology has co-operated with the Division of Botany in Fredericton, N. B., by handling the aphid vectors (*Myzus persicae* Sulzer) used in testing certain potatoes for their resistance to aphid-borne virus diseases. In the course of this testing, serious difficulty was encountered due to the similarity of aphid injury to that caused by Solanum Virus 2 (Potato Virus Y) and Solanum Virus 3 (Potato Virus A) to susceptible potatoes. This difficulty led to a more detailed study of aphid injury on potatoes and of the relative susceptibility of certain commercial varieties to aphid attack. Over a three year period, experiments under field and cage conditions have indicated that a decided variation in response to attack by aphids does exist. The variations in susceptibility have been demonstrated by differences in the degree of foliar injury and by differences in tuber yield by weight. Varietal reactions range from extreme susceptibility to feeding injury, in the foliage of Katahdin, to a substantial resistance in the foliage of Green Mountain. In the latter case, over the entire period of experiment, aphid populations never increased to epizootic numbers, and no serious foliar injury occurred at any time as a result of the feeding of *Myzus persicae* Sulzer. In the case of Katahdin, however, foliar injury occurred within three weeks of initial infestation and under cage conditions the plants were completely dead in slightly more than four weeks from the date of infestation. Green Mountain under similar conditions at this time remained green and thrifty. Other varieties examined have been Irish Cobbler, Bliss Triumph, Sebago, Chippewa, Houma, Warba, President, Up-to-Date, and the U. S. D. A. Seedling No. 41956. Up-to-Date and President both gave promising results as regards foliar resistance to attack.

Further studies, akin to those conducted in regard to alfalfa and peas, and the pea aphid, by the Wisconsin and Kansas Experiment Station workers, are being carried on and will be reported upon in the future.

J. C. Burnham, Division of Entomology and
 D. J. MacLeod, Division of Botany,
 Fredericton, N. B.

GUELPH PRINTING SERVICE

Mailed Monday, March 9, 1942.

nion
on
been

sion
sicae
virus
e to
virus
culty
ative
year
ided
cep-
and
eme
l re
ntire
bers,
g of
rred
ants
esta-
reen
nph,
A.
s as

and
are

and
any,
I. B.